

CLAIMS

What is claimed is:

1. A method for automatic calibration of an ultrasonic frequency device comprising:

generating a series of waveforms each having a characteristic frequency within a frequency range;

applying said series of waveforms to an amplifier;

for each series of waveforms, measuring a value of current flow of the amplifier;

storing the measured values; and

analyzing the stored values to determine a resonant frequency of the ultrasonic frequency device.
2. A method as in claim 1 wherein generating the series of waveforms comprises generating sine waves.
3. A method as in claim 1 wherein generating the series of waveforms comprises digitally synthesizing the waveforms.
4. A method as in claim 1 wherein the determined resonant frequency is stored for subsequent use.
5. A method as in claim 1 wherein the series of waveforms comprise fourteen waveforms within the frequency range of about 48.5 KHz to about 51.5 KHz.
6. A system for automatic calibration of an ultrasonic frequency device comprising:

a generating device for generating a series of waveforms, each waveform having a characteristic frequency within a frequency range;

an amplifier coupled to an output of said generating device;

an ultrasonic transducer coupled to an output of said amplifier;

a measuring device for measuring a value of current flow of the amplifier at each of said characteristic frequencies;

a storage device for storing the measured values; and

an analysis device for analyzing the stored values to determine a resonant frequency of the ultrasonic transducer.

7. A system as in claim 6 further comprising a memory for storing the determined resonant frequency for subsequent use.

8. A stain cleaning apparatus comprising:

a contact surface for contacting an article to be cleaned; and

a system for automatic calibration of an ultrasonic frequency device as in claim 6, wherein the waveforms can be applied to the article at the contact surface.

9. A system for automatically calibrating an ultrasonic frequency device to operate at a resonant frequency of an ultrasonic transducer comprising:

a microcontroller;

a memory coupled to said microcontroller;

a power amplifier coupled to an output of said microcontroller, said power amplifier having an output coupled to said ultrasonic transducer;

wherein said microcontroller is programmed to generate a series of digitally synthesized waveforms, wherein each waveform comprises a characteristic frequency, wherein said microcontroller is programmed to measure power supply current of the power amplifier at each frequency, and wherein said microcontroller is programmed to compare each frequency to one another and to determine a current reading indicative of a resonant frequency of the ultrasonic transducer.

10. A system as in claim 9 further comprising a transformer coupled to said output of said

power amplifier.

11. A system as in claim 9 wherein the ultrasonic transducer comprises a piezoelectric transducer.

12. A system as in claim 9 wherein the ultrasonic transducer is a 50 KHz transducer.

13. A system as in claim 12 wherein the microcontroller while generating the digitally synthesized waveforms, automatically cycles through distinct frequencies spaced within a frequency range of about 48.5 KHz to about 51.5 KHz.

14. A system as in claim 9 wherein the series of digitally synthesized frequencies comprise fourteen distinct frequencies.

15. A system as in claim 9 wherein said system comprises an ultrasonic cleaning system.

16. A stain cleaning ultrasonic frequency device comprising:

a contact surface for contacting an article to be cleaned; and

a system for automatically calibrating the ultrasonic frequency device to operate at a resonant frequency of an ultrasonic transducer as in claim 9, wherein the waveforms can be applied to the article at the contact surface.

17. A software program stored on a computer readable media for directing a microcontroller to execute a procedure for automatic frequency calibration of an ultrasonic transducer of an ultrasonic cleaning system that comprises:

generating a series of waveforms using direct digital synthesis;

measuring a current consumed by an amplifier for each of said series of waveforms;

storing the value of the current of each of said generated waveforms;

analyzing the value of the current of each of said generated waveforms to determine a resonant frequency of the ultrasonic transducer;

storing the resonant frequency as a calibration value for subsequent use; and
setting the operating frequency of the ultrasonic transducer to the resonant frequency.